Appendix C

Modeling Review

T2-050413

MEMORANDUM

DATE: November 21, 2005

TO: Charlie Mazzone, Permit Writer, Air Program

FROM: Kevin Schilling, Stationary Source Modeling Coordinator, Air Program

PROJECT NUMBER: T2-050413

SUBJECT: Modeling Review for the Glanbia Foods, Inc. Tier II Operating Permit Application for their facility near Richfield, Idaho.

1.0 SUMMARY

Glanbia Foods, Inc. (Glanbia) submitted a Tier II Operating Permit application for their whey processing facility located near Richfield, Idaho. Air quality analyses involving atmospheric dispersion modeling of emissions associated with the facility were submitted in support of a permit application to demonstrate that the facility would not cause or significantly contribute to a violation of any ambient air quality standard (IDAPA 58.01.01.403.02).

A technical review of the submitted air quality analyses was conducted by DEQ. The submitted modeling analyses in combination with DEQ's staff analyses: 1) utilized appropriate methods and models; 2) was conducted using reasonably accurate or conservative model parameters and input data; 3) adhered to established DEQ guidelines for new source review dispersion modeling; 4) showed either a) that predicted pollutant concentrations from emissions associated with the proposed facility were below significant contribution levels (SCLs); or b) that predicted pollutant concentrations from emissions associated with the facility, when appropriately combined with background concentrations, were below applicable air quality standards at all receptor locations. Table 1 presents key assumptions and results that should be considered in the development of the permit.

Table 1. KEY ASSUMPTIONS USED IN MODELING ANALYSES

Criteria/Assumption/Result	Explanation/Consideration
Modeled impacts are well below applicable air quality standards.	Unique permit provisions are not necessary to assure compliance with air quality standards.
Propane-fired boilers were modeled assuming 8,760 hr/yr operation at maximum rates.	Daily fuel use monitoring of the boilers is not necessary for the protection of short-term air quality standards, since compliance with standards was based on modeling of maximum potential emissions rates.

2.0 BACKGROUND INFORMATION

2.1 Applicable Air Quality Impact Limits and Modeling Requirements

This section identifies applicable ambient air quality limits and analyses used to demonstrate compliance.

2.1.1 Area Classification

The Glanbia facility is located in Lincoln County, designated as an attainment or unclassifiable area for sulfur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), lead (Pb), ozone (O_3), and particulate matter with an aerodynamic diameter less than or equal to a nominal 10 micrometers (PM_{10}).

There are no Class I areas within 10 kilometers of the facility.

2.1.2 Significant and Full Impact Analyses

If estimated maximum pollutant impacts to ambient air from the emissions sources at the facility exceed the significant contribution levels (SCLs) of IDAPA 58.01.01.006.91, then a full impact analysis is necessary to demonstrate compliance with IDAPA 58.01.01.403.02. A full impact analysis for attainment area pollutants involves adding ambient impacts from facility-wide emissions to DEQ-approved background concentration values that are appropriate for the criteria pollutant/averaging-time at the facility location and the area of significant impact. The resulting maximum pollutant concentrations in ambient air are then compared to the National Ambient Air Quality Standards (NAAQS) listed in Table 2. Table 2 also lists SCLs and specifies the modeled value that must be used for comparison to the NAAQS.

Table 2. APPLICABLE REGULATORY LIMITS

Pollutant	Averaging Period	Significant Contribution Levels[a] ($\mu g/m^3$)[b]	Regulatory Limit[c] ($\mu g/m^3$)	Modeled Value Used[d]
PM_{10}[e]	Annual	1.0	50[f]	Maximum 1st highest[g]
	24-hour	5.0	150[h]	Maximum 6th highest[i]
Carbon monoxide (CO)	8-hour	500	10,000[j]	Maximum 2nd highest[g]
	1-hour	2,000	40,000[j]	Maximum 2nd highest[g]
Sulfur Dioxide (SO_2)	Annual	1.0	80[f]	Maximum 1st highest[g]
	24-hour	5	365[j]	Maximum 2nd highest[g]
	3-hour	25	1,300[j]	Maximum 2nd highest[g]
Nitrogen Dioxide (NO_2)	Annual	1.0	100[f]	Maximum 1st highest[g]
Lead (Pb)	Quarterly	NA	1.5[k]	Maximum 1st highest[g]

a. IDAPA 58.01.01.006.91
b. Micrograms per cubic meter
c. IDAPA 58.01.01.577 for criteria pollutants
d. The maximum 1st highest modeled value is always used for significant impact analysis
e. Particulate matter with an aerodynamic diameter less than or equal to a nominal ten micrometers
f. Never expected to be exceeded in any calendar year
g. Concentration at any modeled receptor
h. Never expected to be exceeded more than once in any calendar year
i. Concentration at any modeled receptor when using five years of meteorological data
j. Not to be exceeded more than once per year

2.2 Background Concentrations

Background concentrations were revised for all areas of Idaho by DEQ in March 2003[1]. Background concentrations in areas where no monitoring data are available were based on monitoring data from areas with similar population density, meteorology, and emissions sources. Background concentrations used in these analyses are listed in Table 3. Monitoring data collected from Rupert, Idaho, were used for background PM_{10} data. Rural/agricultural default values were used for background concentrations of other criteria pollutants.

1 Hardy, Rick and Schilling, Kevin. *Background Concentrations for Use in New Source Review Dispersion Modeling*. Memorandum to Mary Anderson, March 14, 2003.

Table 3. BACKGROUND CONCENTRATIONS

Pollutant	Averaging Period	Background Concentration ($\mu g/m^3$)[a]
PM_{10}[b]	24-hour	76
	annual	27
Carbon monoxide (CO)	1-hour	3,600
	8-hour	2,300
Sulfur dioxide (SO_2)	3-hour	34
	24-hour	26
	Annual	8
Nitrogen dioxide (NO_2)	Annual	17

[a] Micrograms per cubic meter
[b] Particulate matter with an aerodynamic diameter less than or equal to a nominal 10 micrometers

3.0 MODELING IMPACT ASSESSMENT

3.1 Modeling Methodology

Table 4 provides a summary of the modeling parameters used in analyses submitted by Glanbia. CH2M Hill (CH2M), Glanbia's consultant, performed the air quality analyses.

Table 4. MODELING PARAMETERS

Parameter	Description/Values	Documentation/Additional Description
Model	ISCST3	ISCST3 version 04272.
Meteorological data	1987-1991	Boise surface and upper air data
Terrain	Considered	Elevation data from digital elevation model (DEM) files
Building downwash	Considered	The building profile input program (BPIP) was used
Receptor grid	Grid 1	25-meter spacing along boundary
	Grid 2	100-meter spacing out to 1,000 meters
	Grid 3	500-meter spacing out to 5,000 meters

3.1.1 Modeling Protocol

A protocol was submitted to DEQ prior to submission of the application. Modeling was conducted using methods and data proposed in the protocol and those presented in the State of Idaho Air Quality Modeling Guideline.

3.1.2 Model Selection

ISCST3 was used by CH2M to conduct the ambient air analyses. ISCST3 is adequate for the characteristics of the facility and the site to account for the influence of nearby terrain and building downwash. Verification modeling was conducted using ISC-PRIME to better account for downwash. ISC-PRIME utilizes the PRIME downwash algorithm. PRIME is superior to the downwash algorithm in ISCST3 and is included in AERMOD, the recently promulgated replacement model for ISCST3.

3.1.3 Meteorological Data

Site-specific meteorological data are not available for the proposed facility site in Richfield. Boise airport is the closest area where model-ready surface meteorological data are available. These data were used in the modeling analyses.

PCRAMMET, the meteorological data preprocessor for ISCST-3, occasionally generates unrealistically low mixing heights as a result of interpolation algorithms used with the twice daily measured mixing heights. DEQ verification modeling was conducted using meteorological data corrected for low mixing heights. All mixing height values below 50 meters were replaced with a value of 50 meters. Meteorological files were not submitted with the application; therefore, it is uncertain whether CH2M adjusted the data for low mixing heights.

3.1.4 Terrain Effects

The modeling analyses submitted considered elevated terrain, with elevations obtained from USGS digital elevation model (DEM) files. Elevations of terrain were not thoroughly reviewed by DEQ since review of a topographic map indicates the area is nearly flat for dispersion modeling purposes, especially considering that maximum impacts are located very near the emission sources.

3.1.5 Facility Layout

DEQ verified proper identification of the facility boundary and buildings on the site by comparing the modeling input to a facility plot plan submitted with the application and aerial photographs of the area.

3.1.6 Building Downwash

Plume downwash effects caused by structures proposed for the facility were accounted for in the modeling analyses. The Building Profile Input Program (BPIP) was used to calculate direction-specific building dimensions and Good Engineering Practice (GEP) stack height information from building dimensions/configurations and emissions release parameters for ISC.

3.1.7 Ambient Air Boundary

The property boundary was used as the ambient air boundary for the modeling analyses submitted by CH2M. Although the boundary is not fenced, the application indicated the property would be posted with no trespassing signs. DEQ determined these measures are adequate to preclude public access to the facility.

3.1.8 Receptor Network

The receptor grids used by CH2M met the minimum recommendations specified in the *State of Idaho Air Quality Modeling Guideline*. DEQ was not confident the receptor grid was sufficiently dense to resolve the maximum-modeled concentrations; however, since modeled results were well below applicable standards, DEQ determined the grid was adequate to confidently assure compliance with standards.

3.2 Emission Rates

Emissions rates used in the dispersion modeling analyses submitted by the applicant were reviewed against those in the permit application, the engineering technical memorandum, and the proposed permit. The following approach was used for DEQ verification modeling:

- All modeled emissions rates were equal to or greater than the facility's emissions calculated in the PTC application or the permitted allowable rate.
- More extensive review of modeling parameters selected was conducted when model results for specific sources approached applicable thresholds.

Table 5 lists emissions rates for sources included in the dispersion modeling analyses. CO was not included in the modeling analyses because total facility-wide emissions were below the DEQ modeling applicability thresholds.

Table 5. MODELED EMISSIONS RATES

Source Id	Description	Emission Rates (lb/hr)[a]			
		PM_{10}[b]	SO_2[c]	CO[d]	NO_x[e]
BD1	Blau Knox Baghouse Dryer	0.030			
BD2	Niro 50 Baghouse Dryer	0.0150			
BD3	Niro 135 Baghouse Dryer	0.060			
BD4	Niro – R&D Baghouse Dryer	0.0020			
BD5	Phoenix Baghouse Dryer	0.20			
DE6	Phoenix – Indirect Fired Dryer Element	0.035	0.137	0.166	1.22
PV7	Ransome Propane Vaporizer	0.00398	0.0156	0.0189	0.00298
PV8	Ransome Propane Vaporizer	0.00398	0.0156	0.0189	0.00298
PV9	SamDick Propane Vaporizer	0.00240	0.00944	0.0114	0.00180
BC10A	Niro 125 Baghouse Conveyor	0.0070			
BC10B	Phoenix Baghouse Conveyor	0.120			
BC11	Phoenix line to Receiver Baghouse Conveyor	0.120			
BC12	Niro 50 line to Receiver Baghouse Conveyor	0.0250			
BC13	Blau Knox to D7 Receiver Baghouse Conveyor	0.0350			
BH14	Nuisance Dust Collector Baghouse	0.00100			
BH15	Lamsen Vacuum System Baghouse	0.00100			
BC16	Blau Knox to D50 Receiver Baghouse Conveyor	0.0250			
B17	Cleaver Brooks Boiler	0.167	0.436	0.889	5.28
B18	Kewanee Classic III Boiler	0.167	0.436	0.889	5.28

[a] Pounds per hour
[b] Particulate matter with an aerodynamic diameter less than or equal to a nominal ten micrometers
[c] Sulfur dioxide
[d] Carbon monoxide
[e] Oxides of Nitrogen

3.3 *Emission Release Parameters*

Table 6 provides emissions release parameters, including stack height, stack diameter, exhaust temperature, and exhaust velocity. Values used in the analyses appeared reasonable and within expected ranges. Additional documentation /verification of these parameters were not required.

Table 6. EMISSIONS AND STACK PARAMETERS

Release Point /Location	Source Type	Stack Height (m)[a]	Modeled Diameter (m)	Stack Gas Temp. (K)[b]	Stack Gas Flow Velocity (m/sec)[c]
BD1	Point	10.1	0.48	348.2	25.91
BD2	Point	11.3	0.3	348.2	16.17
BD3	Point	16.2	0.51	348.2	15.07
BD4	Point	5.8	0.1	348.2	24.21
BD5	Point	20.3	0.76	348.2	16.56
DE6	Point	19.8	0.36	393.2	8.91
PV7	Point	1.9	0.2	505.4	5.27
PV8	Point	1.9	0.2	505.4	5.27
PV9	Point	2.1	0.15	505.4	5.74
BC10A	Point	20.3	0.15	348.2	10.35
BC10B	Point	20.3	0.15	348.2	10.35
BC11	Point	20	0.15	348.2	20.7
BC12	Point	19.2	0.15	348.2	12.94
BC13	Point	19.8	0.2	348.2	11.67
BH14	Point	6.9	0.2	298.2	0.001
BH15	Point	3.5	0.15	298.2	0.001
BC16	Point	4.3	0.15	348.2	0.001
B17	Point	13.1	0.61	461	10.7
B18	Point	9.8	0.67	461	10.7

[a] Meters
[b] Kelvin
[c] Meters per second

3.4 Results for Significant and Full Impact Analyses

Results of the significant impact analyses are presented in Table 7 for both CH2M's analyses and DEQ's verification analyses. CH2M used ISCST3 and DEQ used ISC-PRIME to better assess plume downwash affects caused by structures at the proposed facility. Differences between the two analyses were inconsequential.

Table 7. RESULTS OF SIGNIFICANT IMPACT ANALYSES

Pollutant	Averaging Period	Maximum Modeled Concentration[a] ($\mu g/m^3$)[b]	SCL[c] ($\mu g/m^3$)	Full Impact Analysis Required?
PM_{10}[d]	24-hour	18.1 (18.1)	5.0	Yes
	Annual	5.58 (4.84)	1.0	Yes
Sulfur dioxide (SO_2)	3-hour	26.5 (26.4)	25	Yes
	24-hour	14.1 (14.1)	5	Yes
	Annual	4.5 (3.8)	1.0	Yes
Nitrogen dioxide (NO_2)[e]	Annual	47.4 (42.9)	1.0	Yes

[a] Values in parentheses are those obtained by CH2M
[b] Micrograms per cubic meter
[c] Significant contribution levels
[d] Particulate matter with an aerodynamic diameter less than or equal to a nominal 10 micrometers
[e] Assumes 100% of NO_x is NO_2

Table 8 shows results of the full impact analyses. All modeled concentrations, for both CH2M's analyses and DEQ's verification analyses, are well below applicable air quality standards.

Table 8. RESULTS OF FULL IMPACT ANALYSES

Pollutant	Averaging Period	Maximum Modeled Concentration[a] ($\mu g/m^3$)[b]	Background Concentration ($\mu g/m^3$)	Total Ambient Impact ($\mu g/m^3$)	NAAQS[c] ($\mu g/m^3$)	Percent of NAAQS
PM_{10}[d]	24-hour	16.0[e] (18.1)[f]	76	92 (94)	150	61 (63)
	Annual	5.58[g] (4.84)[f]	27	33 (32)	50	65 (64)
Sulfur dioxide (SO_2)	3-hour	25.6[e] (26.4)[f]	34	60 (60)	1,300	5 (5)
	24-hour	13.9[g] (14.1)[f]	26	40 (40)	365	11 (11)
	Annual	4.5[g] (3.8)[f]	8	12 (12)	80	16 (16)
Nitrogen dioxide (NO_2)[h]	Annual	47.4[g] (42.9)[f]	17	64 (60)	100	64 (60)

[a] Values in parentheses are those obtained by CH2M
[b] Micrograms per cubic meter
[c] National ambient air quality standards
[d] Particulate matter with an aerodynamic diameter less than or equal to a nominal 10 micrometers
[e] Maximum of all 6th high concentrations at each receptor
[f] Maximum of all 1st high concentrations at each receptor
[g] Maximum of all 2nd high concentrations at each receptor
[h] Assumes 100% of NO_x is NO_2

4.0 CONCLUSIONS

The ambient air impact analysis submitted, in combination with DEQ's verification analyses, demonstrated to DEQ's satisfaction that emissions from the facility will not cause or significantly contribute to a violation of any air quality standard.

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